BANDING SOIL HERBICIDES NOT PROMISING FOR HARDWOOD CONTROL[1]

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ABSTRACT. Banding soil herbicides instead of broadcasting did not reduce the amounts required to kill hardwoods. Bromacil and picloram gave acceptable kills at rates of 10 pounds per acre. At a 5-pound rate, picloram gave marginal kills and bromacil was unsatisfactory. All treatments with fenuron were ineffective.

On upland sandy soils in the Southeast, 1,l-dimethyl-3-pnenylurea (fenuron), 5-bromo-3-sec-butyl-6-methyluracil (bromacil), and 4-amino-3,5,6-trichloropicolinic acid (picloram) are usually effective when broadcast at a rate of 10 pounds per acre (2j 5^ £). The same amount of chemicals is also satisfactory when applied in bands or strips. The cost for 10 pounds per acre of chemical, however, is higher than that for conventional mechanical methods of site preparation (1). Research reported in this paper was designed to determine- if chemical costs could be reduced substantially by applying herbicides in bands.

Study Procedures

Three studies were made on upland forest sites in central Louisiana. Soils are well-drained sandy loams. Stands were composed mainly of seedlings and saplings of red oak *(Quercus falcata* Michx.), sweetgum *(Liquidcoribar styraczflua* L.), blackjack oak ($. *marzlaridica* Muenchh.), mockernut hickory *(Carya tomentosa* Nutt.), red maple *(Acer rubnan* L.), post oak *(Q. stellata* Wangenh.), American beautyberry *(Callicarpa conericaria* L.), and shining sumac *(Rhus copallina* L.).

All hardwood species and sizes were grouped together in measuring results; seedlings and saplings, however, were separated in the first study to determine the effect of stem size on kill.

In the first study, fenuron, bromacil, and picloram were applied at rates of 1, 5, and 10 pounds of active chemical per acre on bands 1 foot wide and 66 feet in length. There were 27 plots, each consisting of a single band. Plots were located 50 feet apart to prevent one treatment from affecting another. Nine treatments were installed June 2, 1965. Final evaluations were made 4% months later. Preselected sample trees were tallied as dead or alive on the treated band and outwards at 2-foot intervals up to 10 feet. This information was needed to determine the distance beyond the treated strips that these herbicides would kill. Trees with sprouts were considered alive, even though the tops were dead.

Cooperators in this study include Dow Chemical Company, the DuPont Company, Tremont Lumber Company, and the Kisatchie National Forest, USDA Forest Service.

Based on information from the initial test, a second study was installed in February 1966 to determine the most effective combination of picloram dosage and spacing of treated bands. Each of the 27 plots consisted of four parallel bands 66 feet long. Bands 1 foot wide were spaced 2, 4, and 6 feet apart, edge-to-edge; active chemicals were applied at rates of 2^, 5, and 10 pounds per acre. There were nine treatments. In this and a subsequent study, 25-foot buffer strips were maintained between plots. In August 1967 the proportion of hardwoods killed was determined midway between the two inner bands on each plot. Trees were tallied as in the previous study.

A third study was installed in March 1967 to compare the effectiveness of fenuron, bromacil, and picloram in parallel bands 1 foot wide. The acre rates were 5 and 10 pounds of active chemical. There were 36 plots, each consisting of four parallel bands 1 foot wide and 66 feet long and spaced 2 and 4 feet apart. The proportion of trees killed was determined between the two inner bands of each plot in August 1968. Twelve treatments were installed. Overall defoliation was estimated to the nearest 5 percent up to 95 percent and at 98 and 100 percent for higher kill.

In all studies, treatments were replicated three times in fully randomized designs. Kills of 91 percent or higher are considered satisfactory, 85 to 90 marginal, and under 85 unsatisfactory. Differences were tested for statistical significance at the 0.05 level.

Results

In the first study, picloram was significantly more effective than the other two herbicides (table 1). On the strips, 50 to 91 percent of the hardwoods died. Kill rates progressively declined away from the strips; at 6 to 10 feet away they averaged less than 5 percent. Rate of application of picloram gave only minor differences in control. Bromacil and fenuron effected kills of 50 percent or less in the treated strips. Kills declined sharply out from the treated bands and did not exceed 8 percent even when adjacent to the bands. Seedlings were more susceptible to the herbicides than saplings. Dosages resulted in no important differences.

All picloram treatments were unsatisfactory in the second study (table 2). Average kills for strip spacings ranged from 16 to 23 percent, and averages for dosages were 16 to 27 percent. The 10-pound rate applied to bands at 2-foot intervals gave the highest kill, 31 percent, while the low rate and wide spacing effected only 7 percent kill. It should be noted that the chemical was applied 30 days before buds started to open; hence, part of the dosage probably was lost from leaching and degradation before trees were able to absorb it effectively.

In the last study, bromacil and picloram were equally effective, and both were superior to fenuron (table 3). Except for bromacil at the 4-foot spacing, they resulted in acceptable kills at the 10-pound rate with both spacings of treated strips. At the 5-pound rate, kill by picloram was about 20 percentage points higher than by bromacil. Spacing of strips and tree size had no effect on kills with either herbicide. Fenuron was unsatisfactory with all dosages and spacings.

Table 1.—*Hardwoods killed 4-1/2 months after treatment*

Herbicide	Rate per acre	Size class	Distance of trees from treated strip									
			On the s trip		0 to 2 feet		2 to 4 feet		4 to 6 feet		6 to 10 feet	
			Present	Dead	Present	Dead	Present	Dead	Present	Dead	Present	Dead
	Pounds		*Hurriber*	*Pot.*	*Number*	*Pot.*	*Number*	*Pot.*	*Number*	*Pot.*	*Number*	*Pot.*
Bromacil	1	Seedlings[1]	*u*	50	24	0	19	0	25	0	91	0
		Saplings[2]	1	0	2	0	3	0	2	0	5	0
Bromacil	5	Seedlings	15	20	40	7	41	5	37	0	96	1
		Saplings	0	• • •	12	8	5	0	6	0	12	0
Bromacil	10	Seedlings	17	24	44	7	53	2	48	0	63	0
		Saplings	1	0	7	0	6	0	3	0	4	0
Fenuron	1	Seedlings	13	0	34	3	45	0	40	0	89	3
		Saplings	0	• • •	6	0	4	0	5	0	17	6
Fenuron	5	Seedlings	13	0	55	4	56	0	51	0	106	0
		Saplings	3	0	4	0	9	0	3	0	15	0
Fenuron	10	Seedlings	13	38	46	4	58	2	45	2	97	0
		Saplings	1	0	6	0	3	0	4	0	10	0
Picloram	1	Seedlings	11	91	25	32	27	0	35	0	71	0
		Saplings	0	• • •	2	50	3	0	6	17	7	0
Picloram	5	Seedlings	17	76	27	52	35	6	45	2	83	0
		Saplings	3	67	9	22	7	14	10	20	15	0
Picloram	10	Seedlings	9	89	19	53	29	17	41	12	50	0
		Saplings	2	50	6	50	8	37	11	18	8	25

Sterns measuring 1 foot tall to 0.5 inch d.b.h.
[2]Stems 0.6 to 4.5 inches d.b.h.

Table 2.—*Kill of hardwoods 18 months after picloram treatment*

Spacings between strips (feet)	Pounds of herbicide per acre			
	2.5	5.0	10	Average
	Percent			
2	20	19	31	23
4	22	17	27	22
6	7	20	22	16
Average	16	19	27	20

Table 3.—*Proportion of trees killed by three herbicides*

Rate (pounds per acre)	Spacing between strips	Herbicide		
		Fenuron	Bromacil	Picloram
	Feet	*Percent*		
5	2	18	66	84
	4	10	60	79
10	2	40	92	90
	4	64	75	93

Discussion

Results in the last two studies are conservative, because kills were recorded only between the treated bands. Since the major objective was to cut costs by lowering chemical requirements, however, the results are not very encouraging. The only effective rates were the same as those recommended for broadcasting.

Banding in conjunction with planting would eliminate most of the labor and equipment costs for herbicide applications. Results of several tests show that planted pines are not severely damaged when the herbicide is 2 feet or more from the plants (1^ 3). It is not known, however, if the dormant season is best for application of soil herbicides.

When applied in parallel strips, picloram gave higher kills than are usually obtained when it is banded around the base of individual trees. Results from other tests also show that it is more effective when broadcast than when concentrated in strips *(1^ 2).* Why the method of application is so influential is not known. Conversely, bromacil and fenuron seem to be affected less than picloram by the method of application (1_3 *2^ 4, 6).*

Results from the second and third studies indicate a need to explore seasons of application. Some research results show that soil herbicides should be applied in the South during late winter and early spring *(1, 2^ 6). Late* winter and spring rains are apparently needed to wash the herbicide into the soil. In addition to the seasonal test, direct comparisons should be made between banding, gridding, and broadcasting. These tests should also include herbicidal mixtures, since chemicals differ in their ability to kill trees of various species.

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